

PROGRESS REPORT ON OPERATION OF SACRAMENTO TYPE
SNOW STORAGE GAGE (RED SANDSTONE)

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UNITED STATES DEPARTMENT OF AGRICULTURE

FOREST SERVICE

THE ROCKY MOUNTAIN FOREST AND RANGE EXPERIMENT STATION

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STREAMFLOW

Watersheds--Forested
(Red Sandstone)

PROGRESS REPORT ON OPERATION OF
SACRAMENTO TYPE SNOW STORAGE GAGE
(Red Sandstone)

By

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Fort Collins, Colorado

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(Red Sandstone)PROGRESS REPORT ON OPERATION OF SACRAMENTO TYPE SNOW STORAGE GAGE
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A Sacramento type snow storage gage complete with alter shield was installed on November 12-13, 1947 at the Red Sandstone Experimental Watersheds. This gage was loaned by the Division of Hydrology, U. S. Bureau of Reclamation, Federal Center, Denver, Colorado, for an indefinite period.

The snow storage gage is located in a cut-over area south of the logging camp and about 1/5 mile downstream from the No. 3 watershed stream gaging station. (See figures 1 & 2). The gage was set up temporarily on November 6; so accumulated precipitation is available since that date. A 37.5 percent calcium chloride solution and 4 ounces of SAE-10W oil were added to the gage when installed on November 13, 1947, according to recommendations by W. V. Gartska, Bureau of Reclamation. The depth of solution placed in the gage was 4.25 inches on this date.

As may be seen in figures 1 and 2, the snow gage support stand is modified from that recommended by the Bureau of Reclamation. There is very little opportunity for snow to accumulate or build up around the base of the gage as occurred in gages installed at Fraser. The gage is fastened to the support tower at a height of 6 feet thus placing the top of the snow gage $9\frac{1}{2}$ feet above the ground surface.

This report covers operation of the snow gage from the date of installation to October 30, 1948. Table 1 lists the snow and rainfall accumulation in the gage with converted rainfall equivalent in inches at intervals during this period.

The operation of this gage in regard to snowfall catch was apparently entirely satisfactory. No snow accumulation was found present on the gage, shield or support at any time when visited. The gage was visited twice during snowstorms. In addition, Nelson, a logger with the Fleming Lumber Company who remained at the logging camp throughout the 1947-48 winter period, was asked to observe the gage operation during this time. He reported that the gage seemed to be operating satisfactorily at all times and that no snow accumulated on or around the gage.

The gage operation in reference to prevention of evaporation losses proved unsatisfactory. As shown in Table 1, one-half inch of rainfall equivalent water was lost from April 22 to May 18. In addition, whatever precipitation occurred during this interval was also lost through evaporation. That some precipitation occurred during this period is evident from precipitation records of the two nearest Weather Bureau gages at Red Cliff and Dillon. These data presented in Table 2 indicate that precipitation was probably somewhere between .10 and 2.00 inches. Adequate temperatures for melting of the snowpack occurred during this interval as judged by the streamflow records. A slight increase in streamflow occurred from April 28 to 30 and then subsided. Streamflow doubled during the May 6-8 period then dropped as freezing

temperatures prevailed until May 13 after which date thawing caused a steady increase in streamflow. By May 18 the streams were flowing at about 60 percent of crest discharges.

Considerable evaporation of stored water in the snow gage occurred from May 18 to June 10. Probably over three inches of rainfall equivalent water was lost from the gage during this interval. A loss of two and three quarters inches of water was measured directly in the gage and in addition, probably from one fourth to three fourths inches of precipitation as judged by adjacent Weather Bureau gages was also lost. High evaporation during this period reduced the snowpack about in half. The maximum discharge was experienced on May 22 and by June 10 the streamflow was still about 60% of maximum.

On June 10, one pint of SAE-10 oil was added to the snow gage. This quantity of oil probably prevented most of the evaporation as judged by comparison with adjacent Weather Bureau gages. However, it is very doubtful that all evaporation losses were prevented.

On the basis of the past season's performance it is recommended that from one to two pints of SAE-10^w oil be used in the Sacramento type snow storage gages during the snow melt period. It is further recommended that a standard Rocky Mountain Forest and Range Experiment Station Gage equipped with 3 ounces of SAE-10^w oil be used to measure summer precipitation. This gage should be painted aluminum or white and placed at a height of 30 inches above the ground. This type gage should give a much more accurate determination of summer precipitation than the snow storage gage which because of its black color and more exposed position is subject to higher evaporation losses.

Table 1. Precipitation Record of 100 Inch Sacramento Snow Storage Gage
At Red Sandstone, Colorado
Elevation 9750 feet

| | | Precipitation | | | | |
|---|-----------|---------------|----------|------------|--------------|--|
| Date | Hour | Solution | Rainfall | Equivalent | | |
| | | Depth | Solution | Period | Accumulation | Remarks |
| | | inches | inches | inches | | |
| 1947 | | | | | | |
| Nov. 6 | 12 Noon | --- | ----- | 1.80 | --- | Snow depth on ground = 18" (water content not determined accurately-- estimated at 1:10 ratio) |
| " 12 | 10 A.M. | --- | ----- | 1.40 | 3.20 | |
| " 13 | 9 A.M. | --- | ----- | .10 | 3.30 | |
| | 5 P.M. | 4.25 | 25.50 | --- | ---- | Show gage installation completed 326 oz. Calcium Chloride & 4 oz. SAE-10W oil added |
| Dec. 15 | 2 P.M. | 4.50 | 27.50 | 2.00 | 5.30 | Snow gage operating satisfactorily |
| 1948 | | | | | | |
| Apr. 22 | 10 A.M. | 6.88 | 39.75 | 12.25 | 17.55 | Over 4 feet snow on ground |
| May 18 | 10 A.M. | 6.75 | 39.25 | -.50 | --- | 2 ft. snow on ground above logging camp |
| June 10 | 9 A.M. | 6.25 | 36.50 | -2.75 | --- | Measured with yardstick |
| All previous measurements made with a yardstick Subsequent measurements taken with standard stick 1" x 5/8" x 40" = .6 Sq. In. | | | | | | |
| June 10 | 9 A.M. | 6.37 | 37.00 | --- | --- | Measured with standard stick |
| | | 6.43 | 37.25 | --- | | 1 pint of SAE-10 oil added |
| July 23 | 9 A.M. | 7.00 | 40.50 | 3.25 | 20.80 | |
| Sept. 8 | 2 P.M. | 7.38 | 42.00 | 1.50 | 22.30 | |
| | 28 3 P.M. | 7.38 | 42.00 | --- | | |
| Oct. 1 | 7 A.M. | 7.44 | 42.25 | .25 | 22.55 | .38" rain on 9/29 (<u>m</u> in can) |
| | 6 11 A.M. | 7.75 | 43.50 | 1.25 | 23.80 | 6" snow on ground |
| | 9 2 P.M. | 7.75 | 43.50 | --- | | |
| | | 4.25 | 25.50 | | | Drained to 4.25" |
| 30 | 4 P.M. | 4.37 | 25.75 | .25 | 24.05 | snow |

Table 2. Precipitation Records for Two Weather Bureau Stations

| Date | Red Cliff (8608') | Dillon (8900') |
|------------------|-------------------|----------------|
| 1948 | inches | inches |
| April 22--May 18 | .08 | 1.79 |
| May 19--June 10 | .25 | .66 |
| June 11--July 23 | 3.92 | 1.96 |



Looking south at

Figure 1. [^]The 100 inch Sacramento Type snow storage gage equipped with alter shield, installed at Red Sandstone watersheds. Observer is painting the gage black so snow will melt more readily and not adhere to metal or wood. He is standing on a 55-gallon oil drum. Average snow depth was 33 inches at this site on November 13, 1947. Looking south.



Figure 2. Same snow storage gage as shown in Figure 1. Looking Southwest. Photo taken on April 22, 1948. 17.5 inches of accumulated melted snow was recorded in gage on this date. About 4 feet of snow remained over the ground. The top of snow gage is $9\frac{1}{2}$ feet above the ground.